The Hidden Perils of Affirmative Action: Sabotage in Handicap Contests*

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Abstract

Contests are ubiquitous in economic and political settings. Contest designers often use tools to make a contest among asymmetric contestants more even, in order to either elicit higher effort levels, or for ethical reasons. Handicapping - in which stronger participants are *a priori* weakened - is one successful tool that is widely used in sports, promotional tournaments and procurement auctions. In this study we show theoretically that participants may also increase their destructive effort, and sabotage their rivals' performance, when handicapping is employed. We empirically verify this prediction using data on 19,635 U.K. horse-races in 2011 and 2012.

JEL Classification: C3, C72, D72, D74, J24

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1 Introduction

Contests, in which individuals have the opportunity to expend costly resources in order to affect the probabilities of winning a prize, are ubiquitous in everyday life. Examples include promotion tournaments, political races, rent-seeking, elections, sports, and various market competitions such as advertising or patent races (see Konrad (2009) for a broader discussion). In many of these situations, a contest designer plans a contest with certain objectives in mind. In sports, promotional tournaments, and social contests with positive externalities - to name a few - maximizing total effort is usually the central objective.

The potential participants of a contest do not necessarily have even abilities or efficiencies. A sufficiently uneven contest, however, has several disadvantages. It may fail to give a level playing field to a historically disadvantaged or minority group. As a result, contestants from a minority group may decide not to participate in the contest. It can also fail to elicit significant efforts from weaker participants if they perceive their probability of winning to be too small (Lazear and Rosen (1981) and Runkel (2006)). Knowing this, a stronger participant also has limited incentives to exert high effort, and the overall effort exerted in a sufficiently uneven contest is usually low. Hence, ex-ante differences in efficiencies or abilities among participants is a matter of concern for a contest designer interested in maximizing total effort.

In this context, Brown (2011) empirically finds that the presence of a 'superstar' - in this case, an in-form Tiger Woods - serves to reduce the absolute performance (and implicitly, the effort) of his fellow professional golfers. Sunde (2009) finds a similar effect in women's professional tennis.

It would be natural, therefore, to conclude that a contest designer should aim to level the playing field, since it will make the contestants exert more effort. Handicapping - where stronger participants are *a priori* weakened - is one such tool that is widely used in sports, promotional tournaments and other types of contests. Firms that use contests as a motivational tool often handicap those of superior ability, or give head-starts to those with inferior ability. Similarly, expenditure in political campaigns is often capped - thereby handicapping the candidate with the richest connections (Che and Gale (1998)). It is also common to observe handicapping of an outsider in a local procurement auction, or in internal promotional tournaments (Chan (1996)). One extreme policy used to handicap the most efficient players is to exclude them altogether (Baye *et al.* (1993)). All these designs are implemented essentially to 'level the playing field' for all the participants, to rescale the ex-ante likelihood of winning for all the participants, and to incentivize participants to exert higher levels of efforts in the contest. In sports this is known as 'competitive balance' and is an important component when designing sports tournaments (Szymanski (2003), Fort and Maxcy (2003)).

Economists have also studied and analyzed the effects of handicapping in the context of affirmative action. Overall, both theoretical and applied results support an employment of affirmative action tools in the interests of higher effort as well as equality. Fryer and Loury (2005) show that profile-specific affirmative actions can increase effort, and reduce inequality. Fu (2006) shows that such policies may improve incoming test scores for an academic institution, while still admitting students from minority backgrounds. Similar results are confirmed in different contest structures and information settings by Franke (2012a) and Calsamiglia et al. (2013). Kirkegaard (2012) lays down mechanisms by which an affirmative action policy can also improve effort. Empirically, the issue of levelling the playing field is supported by Schotter and Weigelt (1992), who run a laboratory experiment with equal opportunity programs and affirmative actions. They show that such policies benefit the disadvantaged group and at the same time increase the effort levels of all contestants. Along the same lines as Brown (2011), Franke (2012b) investigates the area of amateur golf tournaments and shows that handicapping the efficient players elicits higher effort in the tournament.

Implementation of such policies, however, is not without danger. Contests between participants of comparable ability may see more effort diverted to destruction (i.e., sabotage), rather than production.[1] In a political race this may take the form of negative smear campaigning, rather than a positive focus on the issues (Skaperdas and Grofman (1995)). In a

[1]Sabotage in static and dynamic contests has been considered by a number of authors (e.g. Lazear (1989), Konrad (2000), Chen (2003), Kräkel (2005), Amegashie and Runkel (2007), Münster (2007), Soubeyran (2009) and Gürtler and Münster (2010)). Although experimental evidence has been forthcoming (e.g. Harbring *et al.* (2007), Harbring and Irlenbusch (2008) and Carpenter *et al.* (2010)), there has been relatively little field analysis. Notable exceptions include the work of Garicano and Palacios-Huerta (2014), del Corral *et al.* (2010), Balafoutas *et al.* (2012) and Deutscher *et al.* (2013) who examine fouls, as a form of sabotage, in sports. Please see Chowdhury and Gürtler (2013) for a comprehensive survey on sabotage in contests.

firm, sabotage could involve the spreading of malicious rumours about a colleague (Lazear (1989)). In markets, this may mean negative advertising or even introducing ways to increase rivals' costs (Salop and Scheffman (1983)). On a football (soccer) pitch, this may mean using fouls to stop rival teams scoring (Deutscher *et al.* (2013)). Regardless of the setting, any increase in sabotage is to the detriment of the contest designer. Up until now, however, no study has attempted to investigate whether the policies used to elicit higher effort, or reduce inequality, actually increase sabotage in a contest. In this paper we aim to answer this question.

We analyse an environment in which there is both handicapping and sabotage, by examining 19,635 horse races run in the U.K. in 2011 and 2012.[2] Of these, 11,766 (59.9%) are handicap races. In handicap races, horses within a range of abilities are permitted to take part, but superior horses are given heavier weights so that all horses have a similar probability of winning.[3]. The BHA Guide to Handicapping states that

'A handicap is a race for which horses are allotted weight, based on their ability on the racecourse, to try to equalize their chances of winning... The Handicapper hopes to make the race exciting and competitive for the owners and racegoers'

There is also a second ingredient to our data. The BHA investigates 'interference' between horses during each race. Interference can include one horse knocking into another horse, a horse forcing another off their racing line, and even cases of a jockey stealing another jockey's whip during the race.[4] While interfering with another horse, the jockey is exerting effort to reduce the likelihood of the victim winning. Interference is, in other words, sabotage. In 2011 and 2012 alone, there were 1,099 cases of interference.

[2]Horse-racing has been used by other authors to examine contest theory. For example, Lynch (2005) uses Arabian horse-racing data to examine how the structuring of the prize schedule, and the translation of effort into reward, affects aggregate effort in contests. Coffey and Maloney (2010) use horse and dog racing data to disentangle the effect of incentives and selection on effort in contests.

[3]Full details on the handicapping system in horse racing can be found on the British Horse-Racing Authority website http://www.britishhorseracing.com

[4]Lester Piggott is the most (in)famous jockey to commit such an offense, stealing the whip of Alain Lequeux in a race in France in 1979 (*The Times*, November 15th 2008). He later explained that Alain 'did not seem to mind and [had] got no chance [of winning]' (*The Guardian*, 14th December 2003).

We find, first of all, that handicapping does its job in levelling the field: favourites (often, the best horses) are less likely to win handicap races than they are to win non-handicap races. Further, the betting market anticipates this: the standard deviation in pre-race odds is lower in handicap races than non-handicap races (i.e., more horses have a shot at winning). Second, and the key result in our paper, is that participants in handicap races are substantially more likely to commit sabotage than those competing in non-handicap races. The incidence of sabotage is particularly high in close handicap races (as measured by the standard deviation in pre-race odds), and even extends to close non-handicap races. In other words, a levelling of the field appears to increase the likelihood of destruction in contest environments. Finally, we find that there are strong incentives for jockeys to employ destructive strategies as it helps the saboteur to improve his/her final rank and to win the race. The enactment of sabotage gains the saboteur 1.43 places, on average, relative to the betting market's pre-race expectations of their finishing position. Combining these results, we conclude that if not taken care of, sabotage may partially offset the benefits, in positive effort inducement and equality, that arise with tools such as handicapping.

The rest of this paper is structured as follows. In Section 2 we provide a theoretical benchmark of sabotage in contests. In Section 3 we outline the data relating to handicapping and interference, and in Section 4 we conduct our empirical analysis. Section 5 concludes.

2 A Theoretical Benchmark

We introduce a simple model to show how actions that are intended to reduce ex-ante efficiency difference among players may increase sabotage. We use a tournament model with sabotage similar to Lazear (1989). There are two risk-neutral players, i and j, who compete for a prize of common value v. Player i can either expend productive effort e_i that improves his own probability of winning; or can exert destructive sabotage s_i that reduces the effort level of their rival, and as a result the probability of their rival winning. Furthermore, Player i has ability a_i that is given exogenously. Without loss of generality assume $a_i > a_j$, i.e., Player i is a-priori more efficient than Player j. This type of specification is common while considering 'unfair' contests and analysing the effects of asymmetry or affirmative action tools, while keeping other effects the same (see, for instance, Schotter and Weigelt (1992, pp. 517) or Gürtler and Gürtler (2015)).

Let us now denote this a-priori efficiency difference as $\triangle a = a_i - a_j$. The final output y_i produced by player i is given as

$$y_i = a_i + e_i - \alpha s_j + \epsilon_i$$

for $\alpha < 1$, and ϵ_i is random noise. The output function is analogous for Player j. Exerting effort and sabotage are both costly. Consider the total cost function as:

$$c_i = c(e_i, s_i)$$

The cost function has the following properties: $c(0,0) = 0$, $c_1 > 0$, $c_{11} > 0$, $c_2 > 0$, $c_{22} > 0$, $c_{12} > 0$, ensuring a standard convex shape.[5] We further assume enough convexity and Inada-type conditions that ensure the existence of an interior solution. Although we do not explicitly model possible punishment as a consequence of detected sabotage, the cost function implicitly incorporates exactly that. The convexity can imply a higher likelihood of detection with sabotage, and also a higher level of punishment.

Following the standard procedures in Tournament models, the player with the highest output wins the prize. Thus, the contest success function can be written as:

$$p_i = \begin{cases} 1 \text{ if } & y_i > y_j \\ \frac{1}{2} \text{ if } & y_i = y_j \\ 0 \text{ if } & y_i < y_j \end{cases}$$

Hence, the pay-off function for Player i can be written as

$$\pi_i = p_i v - c(e_i, s_i)$$

$$= p((a_i + e_i - \alpha s_j + \epsilon_i) - (a_j + e_j - \alpha s_i + \epsilon_j) > 0)v - c(e_i, s_i)$$

$$= p((\triangle a + (e_i - e_j) - \alpha(s_j - s_i)) > (\epsilon_j - \epsilon_i))v - c(e_i, s_i)$$

[5] Here a single subscript means first order partial derivative with the first or the second argument, and a double subscript means a second order own or cross partial.

$$= G(\triangle a + (e_i - e_j) - \alpha(s_j - s_i))v - c(e_i, s_i)$$

where $G(.)$ is the CDF of $\epsilon_i - \epsilon_j$, with unimodal PDF $g(.)$.

Player i will try to maximize payoff π_i with respect to e_i and s_i. The first order conditions are given as

$$\frac{\partial \pi_i}{\partial e_i} = g(\triangle a + (e_i - e_j) - \alpha(s_j - s_i))v - \frac{\partial c}{\partial e_i} = 0 \tag{1}$$

$$\frac{\partial \pi_i}{\partial s_i} = \alpha g(\triangle a + (e_i - e_j) - \alpha(s_j - s_i))v - \frac{\partial c}{\partial s_i} = 0 \tag{2}$$

Similarly the pay-off function for Player j:

$$\pi_j = (1 - G(\triangle a + (e_i - e_j) - \alpha(s_j - s_i)))v - c(e_j, s_j)$$

And the first order conditions to maximize pay-off are:

$$\frac{\partial \pi_j}{\partial e_j} = g(\triangle a + (e_i - e_j) - \alpha(s_j - s_i))v - \frac{\partial c}{\partial e_j} = 0 \tag{3}$$

$$\frac{\partial \pi_j}{\partial s_j} = \alpha g(\triangle a + (e_i - e_j) - \alpha(s_j - s_i))v - \frac{\partial c}{\partial s_j} = 0 \tag{4}$$

From (1) and (3), we observe that $\frac{\partial c}{\partial e_i} = \frac{\partial c}{\partial e_j}$. Similarly, from (2) and (4), we obtain $\frac{\partial c}{\partial s_i} = \frac{\partial c}{\partial s_j}$. It follows that there exists a symmetric equilibrium, with $e_i^* = e_j^* = e^*$ and $s_i* = s_j* = s^*$. The above first-order conditions then simplify to

$$g(\triangle a)v = \tfrac{\partial c(e^*, s^*)}{\partial e_i}$$

and

$$g(\triangle a)v = \tfrac{\partial c(e^*, s^*)}{\partial s_i}.$$

The convexity conditions of the cost function, $c_{11} > 0$ and $c_{22} > 0$, then imply that both e^* and s^* are increasing in $g(\triangle a)$.

Recall that $\triangle a = a_1 - a_2$ is the a-priori efficiency difference. In a contest it may be possible for the designer to reduce the efficiency difference either by employing handicapping (decreasing a_i) or by allowing head-starts (increasing a_j). In either case, $\triangle a$ goes down and, given the shape of the PDF, $g(\triangle a)$ increases. This results in an expected increase in equilibrium effort e^*. It is also simple to show that the probability that the most efficient player wins decreases. However, as a by-product, the contest designer is also faced with a higher level of sabotage s^*.

We have already discussed that some tools - such as handicapping - are implemented to increase equilibrium efforts. However, it is clear that it is also in the interest of players to increase their employment of sabotage when such tools are utilised. The act of sabotage is detrimental to the other players, the designer and even agents unrelated to the contest (see Chowdhury and Gürtler (2013) for a detailed discussion of this). Hence, while our model indicates that an implementation of handicapping may help to achieve certain objectives of the designer, it also increases the level of sabotage. Such sabotage may lessen or, in an extreme case, offset the benefits achieved from the original increase in productive effort.

In the next two sections we present field evidence to verify these predictions. We first establish that handicapping fulfils its objective of levelling the playing field. We then show that, as a by-product, sabotage goes up. We also show that sabotage helps in the winning of contests.

3 Data

We obtained data on 19,635 U.K. horse races in 2011 and 2012 from Betwise (www.betwise.co.uk), a betting information company. This data includes information on the time and date of each race, the class of the race (which ranges from 1 (top) to 7 (bottom)), the number of horses in each race, the prize money on offer to the winner, and the distance over which the race is run. In addition, we have the type of race (e.g. flat - i.e., a standard race, and jump - i.e., a hurdle race or steeplechase) and whether or not the race was a handicap. Please see the BHA Guide to Racing for more details on the types of racing in the U.K..

Supplementing this race data, we have information on each of the horses competing. This includes the age of the horse, and also the bookmaker odds at the time the race begins, otherwise known as the starting price. Summary statistics on race and horse data can be found in Table 1. As expected, the standard deviation of the implied win probability (calculated from the starting price) is larger for non-handicap races than for handicap races. This reflects the fact that without handicapping, certain horses have very little chance of winning. Reflecting the uncertainty created by handicapping, the favourite wins 41.43% of non-handicap races, but only 27.5% of handicap races.

[Insert Table 1 here]

We also require data related to interference. The BHA entrust multiple race stewards to investigate and punish cases of interference. Information on all steward's enquiries relating to interference can be found on the BHA webpage.[6] Details of the procedures followed by the stewards can be found in BHA Manual B Schedule 6. Below is a typical example of the output displayed after an enquiry, in this case from a race at Towcester on 10th January 2011.

'The Stewards held an enquiry into possible interference approaching the final flight. They found that the winner, BADGERS COVE (IRE) ridden by Charlie Poste, had interfered with OVERNIGHT FAME, ridden by Denis O'Regan, placed second. They found Poste in breach of Rule (B)54.1 and guilty of careless riding in that he allowed his mount to drift to the right. They suspended him for 2 days as follows: Monday, 24th and Tuesday, 25th January 2011'.

If we assume handicap races are more competitive, horses will spend more time in close proximity to each other in these races. We are therefore keen to distinguish between cases of accidental interference (which may occur as a result of this proximity) and intentional interference. The BHA procedures allow us to do precisely that. Consider the following case of accidental interference from a race at Wolverhampton also on 10th January 2011. Such cases are not classified as sabotage in our data-set.

'The Stewards noted that DAUNTSEY PARK (IRE), unplaced, had interfered with the winner, BLACK COFFEE, at approximately five furlongs out, but after viewing a video

[6] www.britishhorseracing.com/resources/about/whatwedo/disciplinary/stewardsEnquiries.asp.

recording of the incident, they were satisfied that it was caused by accident. They therefore took no further action'.

We married the data on guilty interference with the race and horse data described in Table 1. We only analysed data from racetracks with at least one incident of interference over the two year sample. This was to ensure that racetracks outside of the BHA's jurisdiction, or racetracks with overly lenient stewards, did not cloud our analysis. In our sample from 2011 and 2012, there were 1,099 cases of interference, of which 787 occurred in handicap races. 0.46% of competitors were guilty of interference in non-handicap races, but this rises to 0.68% for handicap races. In the following section, we present our more formal analysis. For clarity, we will now refer to interference as sabotage.

4 Analysis

Our analysis consists of three parts. First, we investigate whether handicapping - similar to other tools that level the playing field - serves its purpose and creates relatively even races. Then we compare the frequency of sabotage in handicap and non-handicap races, and attempt to establish the underlying mechanism for any differences. Finally, we investigate the effect of sabotage on the saboteur's performance.

We start with a testable hypothesis on handicapping and the likelihood of the horse with the highest efficiency (the favourite) winning. We investigate whether the favourite wins with higher probability in handicap or non-handicap contests.

Hypothesis 1. Handicap races have more uncertain outcomes - both ex-ante and ex-post - compared to non-handicap races.

To test this hypothesis, in Table 2 we regress an indicator variable equalling 1 if the favourite wins the race, and 0 otherwise, on an indicator variable equalling 1 if the horse was running in a handicap race, and 0 otherwise. As one race is one observation at this stage, we cluster standard errors at the race meeting level (there are typically 5-6 races at each meeting). If the favourite is less likely to win a handicap, this would suggest that handicapping creates greater uncertainty in the race outcome. Indeed, in Regression 1 this is the result we find with significance at the 0.1% level. In Regression 2 we include control variables, related to the race, and find the result to be robust.

[Insert Table 2 here]

Whether the favourite won the race is a relatively blunt measure of the uncertainty of the race outcome, as it considers only the top horse in each race. Furthermore, it is an ex-post measure of uncertainty, and we would also like an ex-ante measure to test Hypothesis 1. Therefore, in Table 3 we use the standard deviation of implied win probability within a race as the dependent variable. This measure incorporates data on all horses in the race. If the standard deviation is low, this implies that the race is relatively even, as the horses start the race at similar odds. As expected, we find that handicap races are considerably more even than non-handicap races (significant at the 0.1% level) and this result is robust to the inclusion of race control variables. In addition we find that flat races have lower standard deviations in implied win probability (significant at the 0.1% level), and therefore it can now be argued that the outcome of flat races are more uncertain than the outcome of jump races (at least ex-ante). It is this uncertainty - which arises either due to the nature of the contest, or due to the handicapping design - that we believe will incentivize sabotage.

[Insert Table 3 here]

Another way to consider the effect of handicapping on the full spectrum of horses - and indeed to incorporate race results in addition to race forecasts - is to calculate the correlation between a horse's predicted finishing position and their actual finishing position. This can then be compared for handicap and non-handicap sub-samples. A horse's predicted finishing position can be inferred by comparing the odds of all horses in each race. Those with the shortest odds are predicted to finish first, those with the second shortest odds are predicted to finish second, and so on. We find that the correlation between a horse's predicted position and their actual position is 0.5138 for handicap races, while the same correlation for non-handicap races is 0.6577. Although the outcome of handicap races are not perfectly random, this is further evidence that handicapping does indeed serve its purpose of making the contest more uncertain.

Having demonstrated that handicapping fulfils its task of levelling the field, we now focus on whether sabotage is more prevalent in handicap contests. We introduce the following hypothesis:

Hypothesis 2. Sabotage is employed more in a handicap contest compared to a non-handicap contest.

To test this hypothesis, in Table 4 we present two logit regressions relating to sabotage. These regressions incorporate each horse performance, and consider horse-specific variables such as age and implied win probability, rather than considering only race features as before. We therefore now cluster standard errors at the race-level. In Regression 1, an indicator variable, equalling 1 if the horse/jockey was a saboteur and 0 otherwise, is regressed on an indicator variable equalling 1 if the horse was racing in a handicap race. The relationship is positive and significant (at the 0.1% level). In Regression 2, we include control variables. Once again, the relationship is positive and significant (at the 0.1% level), and gives an odds ratio of 1.57 of sabotage in a handicap race relative to a non-handicap race. In other words, destructive effort is clearly more prevalent in handicap contests relative to non-handicap contests.

A closer look at our control variables also reveals that sabotage is more of an issue in shorter races, increases with prize money (though much of this effect is captured by the class of the race), is often carried out by horses in the prime of their careers (witness the concave relationship between horse age and the propensity to engage in sabotage), and is predominantly carried out by horses/jockeys with a good chance of victory (implied win probability is positive and significant). However, most of these effects have weaker statistical significance than the effect of handicapping. It is interesting to observe that sabotage occurs more often, even after controlling for other factors, in flat races. It can be recalled from Table 3 that flat races were, like handicap races, relatively even contests.

[Insert Table 4 here]

One problem with our empirical set-up is that, even though the same jockeys will perform in both handicap and non-handicap races, they are not randomly assigned across races. One option, to partially circumvent this problem, is to exploit the abundant variation in the closeness of both handicap and non-handicap races. Handicap races will differ in their closeness, perhaps depending, amongst other things, on the competence of the handicapper. If the handicapper does a poor job, or if important information on the quality of horses arrives after the weights are decided, horses will go off at vastly different odds. Similarly, certain non-handicap races may be very closely matched without a handicapper's intervention. To get closer to establishing that handicapping drives sabotage, we should examine whether close races - both of the handicap and non-handicap variety - attract more sabotage than less close races.

Our measure of the closeness of the race - ex-ante - is the standard deviation of implied win probability (as used in Table 3). In Regression 1 of Table 5, we regress our saboteur indicator on this standard deviation plus the other control variables used in Table 4 (including the handicap indicator). As expected, we find that sabotage is indeed more prevalent in close contests (i.e. when the standard deviation of implied win probability in the race is low). In Regressions 2 and 3 we exclude the handicap race indicator and instead regress our saboteur indicator on the remaining variables, but this time for sub-samples of handicap and non-handicap races. In Regression 2 we find that there is a greater prevalence of sabotage in close handicap contests (compared to less close handicap contests) with significance at the 5% level. In Regression 3 we find that close non-handicap races are also afflicted by higher levels of sabotage than less close non-handicap contests (with significance at the 1% level). In other words, the closer the race ex-ante, the more likely we are to observe sabotage, regardless of whether the race is a handicap or not. This result gives us greater confidence that it is in fact the closeness created by handicapping that drives higher levels of sabotage in those races.

Does the prevalence of sabotage in close contests reflect the greater returns to sabotage in such races, as the model in Section 2 implies? Or, are competitors equally keen to engage in sabotage across all races, but just find that close races give them the necessary proximity? These questions have important implications. If the former is true, then it suggests that contest designers should avoid levelling the playing field for fear of increasing destructive effort. If the latter is true, greater importance should be given to keeping competitors (whether of even or uneven abilities) apart.

It is difficult to disentangle these two mechanisms in the data, but one option is to examine which types of competitors are engaging in sabotage. If all competitors in handicap races can be found engaging in sabotage, then the proximity created by even races may be the key factor. If, on the other hand, top horses are disproportionately responsible for sabotage in handicap races, then this suggests that it is the greater returns to sabotage in handicap races that lies behind our earlier results. Note that handicapping will just as likely keep those trailing as those leading together during a race. The key question is whether those trailing are just as likely to engage in sabotage.

It turns out that the analysis in Table 5 can help to answer this question. In Regressions 2 and 3 we separated out handicap and non-handicap races, with the primary aim of seeing whether close races - whether with a handicap design or not - were subject to more sabotage. Yet, looking at the coefficient associated with implied win probability, and comparing it across handicap and non-handicap sub-samples - provides insight for our more recent questions. In both types of races it is the stronger horses that disproportionately engage in sabotage (see the positive coefficient associated with implied win probability). What's more, the coefficient is larger for the handicap sub-sample, suggesting that, once you control for other race characteristics, sabotage is even more concentrated amongst the leading runners and riders in handicaps. Rather than high levels of sabotage simply being due to new-found proximity, it appears that sabotage in handicap races is largely driven by the greater returns to sabotage in these races.

[Insert Table 5 here]

Our final aim in this study is to quantify the effect of sabotage on contest outcomes. It is one aspect to establish that handicap contests are more susceptible to sabotage, but whether this destructive practice actually works in the saboteur's favour is still not clear. We test the success of sabotage in our next hypothesis:

Hypothesis 3. Employment of sabotage improves the performance of the saboteur in contests.

In Table 6a we regress an indicator variable equalling 1 if the horse/jockey won the race, and 0 otherwise, on an indicator variable equalling 1 if the horse/jockey was a saboteur, and on the implied win probability of the horse (as inferred from the starting price). We find that sabotage does indeed improve the saboteur's chances of victory (significant at the 0.1% level) relative to the betting market's pre-race expectations. The coefficient associated with the saboteur indicator variable implies an odds ratio of 2.95 of a saboteur winning the race relative to a non-saboteur with the same pre-race prospects. This result is most vividly captured in Figure 1. We plot the average win indicator (i.e. the win frequency) for saboteurs, victims and uninvolved third parties. Compared to the implied win probabilities, and using third parties as a reference point, saboteurs win more often than their pre-race odds would suggest, while the prospects of victims are clearly hampered by the saboteur's actions. This is particularly apparent for lower implied win probabilities, where there are more observations and where much of the noise is averaged out.

[Insert Table 6 here]

In the remainder of Table 6a we examine whether the effect is more pronounced in handicap/non-handicap/jump and flat races. While sabotage is, initially, more likely to be effective in handicap contests as the races are close, we would expect competitors to use sabotage in both types of contests until the marginal impact is equal across each type of race. Indeed, this appears to be the case as the coefficients across handicap and non-handicap races are similar. The effect of sabotage on the saboteur's win prospects are higher, however, in jump races compared to flat races, suggesting that there are some unexploited opportunities for sabotage in the former.

[Insert Figure 1 here]

One problem with our initial choice of performance measure (whether the horse won the race), is that the out-performance of the saboteur could be confounded with the well-known favourite-longshot bias. This is the empirical regularity - dating from Griffith (1949) - that the returns to betting on favourites exceed the returns to betting on longshots.[7]. This means that favourites (longshots) will win more (less) often than their odds suggest. As saboteurs are disproportionately favoured horses (see Table 4), the favourite-longshot bias could generate the results in the top panel of Table 6 without sabotage actually being beneficial for the saboteur.

To circumvent this issue we also used the following measure of performance used by Brown (2012):

$$Performance = \frac{PredictedFinishingPosition - ActualFinishingPosition}{NumberofHorsesinRace} \tag{5}$$

The predicted finishing position is constructed by ordering the horses in each race by their odds. Those with the shortest odds are predicted to finish first, those with the second shortest odds are predicted to finish second, and so on. If *Performance* is negative, the horse has underperformed, while a positive *Performance* signals out-performance. This measure allows us to capture the effect of sabotage on the full spectrum of horses, unlike the previous specification which focused only on the identity of one horse (the winner). This measure also has a negative bias when it comes to favoured horses. For example, a horse predicted to finish first can only under-perform (vice versa, a horse predicted to finish last can only outperform). Therefore, in each of the following regressions we control for the predicted percentile of the horse. For example, a horse predicted to finish 4th out of 14 horses would have a predicted percentile of $100 * (4/14) = 28.57th$.

From Table 6b we can see that the saboteur does indeed gain places (significant at the 0.1% level). Judging by the size of the coefficients - and the average number of horses in each race (see Table 1) - the saboteur finishes, on average, 1.43 positions higher than betting market expectations as a result of their actions. We also replicate this analysis

[7]See Ottaviani and Sørensen (2008) for a survey of the explanations for the bias.

for handicap/non-handicap/jump and flat race sub-samples. The overall result is captured in Figure 2, where we average the performance measure for saboteurs, victims and third parties for each predicted percentile (rounded to the nearest whole number) across the full sample. Saboteurs significantly outperform expectations, while victims suffer relative to pre-race expectations. This positional gain explains why saboteurs sabotage.

[Insert Figure 2 here]

5 Conclusion

Contests are a family of games where players make costly sunk investments in order to win rewards. There are very many situations in the field in which contests are employed to select winners for rewards. Tools such as handicapping, head-starts, caps on effort etc. are often used in political and economic contests, sometimes for ethical reasons (e.g. in affirmative actions), but also to increase the aggregate effort of unevenly able participants. The existing literature show that these tools, in general, are capable of achieving the objectives of the designer.

In this paper we introduce, for the first time, analyses of sabotage behaviour in contests that use a handicapping tool to level the playing field. We show theoretically that implementation of such policies indeed increases equilibrium effort. However, as a by-product, incidences of sabotage also increase. We utilise a unique data set from the British horse-racing industry to empirically verify this second prediction. We demonstrate that participants indeed display a greater propensity for destructive acts in contests where handicapping is implemented.

It has previously been shown that effort, particularly from weaker participants, is higher in even contests (see, for example, Che and Gale (1998)). Studies such as Tsoulouhas *et al.* (2007) argue against such policies - common in workplace environments (Pfeifer (2011)) - as they may reduce the ability of the future players in a repeated setting. However, our results shed light on the possible harmful effects of levelling the contest even in a static setting, as it appears to incentivize sabotage.

Our results are of particular interest in settings such as workplaces, political campaigns, and sports, in which it is possible for players to sabotage rivals. (Contests in which players cannot access their rivals - e.g. applications to colleges, innovation tournaments etc. - will be safe from the implications of our results). This means that capping campaign budgets in political races, handicapping ‘superstar’ workers in internal labour markets, or giving head-starts to local companies may even result in lower welfare than the status-quo.[8] As there are both benefits, in terms of higher effort, and damage - in terms of sabotage - in levelling the playing field, our results also suggest that an optimal level of handicapping could be chosen to elicit the highest net constructive effort in a contest.

[8]Several designs popularly used to reduce sabotage (see Chowdhury and Gürtler (2013)) are not necessarily employable in every setting. Sabotage might be reduced by introducing detection procedure and punishments, but these also incur individual and social costs.

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Tables

Table 1. Summary Statistics					
Races	All (N=19635)	Hcap (N=11766)	Non Hcap (N=7869)	Jump (N=6631)	Flat (N=13004)
No. of Runners	9.33262	9.793898	8.642903	8.811793	9.598201
	(3.448693)	(3.427932)	(3.363705)	(3.586575)	(3.345284)
Win Prize Money (000s of GBP)	9.661175	7.395767	13.04849	9.102513	9.946048
	(33.85377)	(17.34128)	(48.89924)	(26.31808)	(37.10964)
Distance (000s of yards)	2.748365	2.766901	2.720649	4.44328	1.884094
	(1.407199)	(1.436047)	(1.362546)	(.7512469)	(.7001933)
Horse Runs	All (N=183046)	Hcap (N=115023)	Non Hcap (N=68023)	Jump (N=58417)	Flat (N=124629)
Age (Years)	4.995012	5.453961	4.218955	6.877912	4.112446
	(2.300088)	(2.288042)	(2.103686)	(2.018053)	(1.849477)
Implied Win Probability	0.1236974	0.1185883	0.1323367	0.1297913	0.1208411
	(.1147714)	(.0899741)	(.1471023)	(.1248645)	(.1096053)

Summary statistics for 19,635 horse races in the U.K. in 2011 and 2012. Column 1 encompasses the full sample, with sub-samples relating to handicap races, non-handicap races, jump races, and flat races in columns 2, 3, 4 and 5 respectively. The top panel focuses on race statistics with individual horse statistics in the bottom panel. The main measure is the mean, with standard deviations in parentheses. Implied Win Probability is calculated as 1/(SP+1) where SP is the starting price odds (a summary measure of British bookmaking odds at the start of the race).

Table 2. Favourite Wins		
Dependent Variable: Favourite Wins	All	All
Intercept	-0.3462837***	0.3184456***
	(.0231582)	(.0638316)
Handicap Race	-0.6229676***	-0.5503379***
	(.0311138)	(.0321488)
Jump Race		0.0941063
		(.0618891)
Top Class Race		-0.2304808***
		(.0628121)
No. of Runners		-0.0791053***
		(.004999)
Win Prize Money (000s of GBP)		0.0007709
		(.0005061)
Distance (000s of yards)		-0.0008574
		(.0207323)
No. of Clusters (Meetings)	2812	2812
No. of Obs. Where Dep. Var. =1	6496	6496
No. of Obs.	19635	19635
Pseudo R^2	0.0164	0.0294

Coefficient estimates when an indicator variable equalling 1 if the favourite won the race, and 0 otherwise, was regressed on an indicator variable equalling 1 if the races was a handicap race, and 0 otherwise. A logit specification was used and race control variables were added in Regression 2. (Races of class 1 or 2 are designated as top class). Heteroskedasticity-consistent standard errors (in parentheses) were clustered at the meeting level, and ***, **,*, and . indicates significance at the 0.1%, 1%, 5%, and 10% level respectively.

Table 3. Even Races		
Dependent Variable: Std. Dev. of IWP in Race	All	All
Intercept	0.1525457***	0.2218532***
	(.000854)	(.0018033)
Handicap Race	-0.0653566***	-0.0560998***
	(.0008375)	(.0006971)
Jump Race		0.0077738***
		(.0013661)
Top Class Race		-0.0104103***
		(.0013779)
No. of Runners		-0.0081184***
		(.0001291)
Win Prize Money (000s of GBP)		0.0000548**
		(.0000158)
Distance (000s of yards)		-0.0004592
		(.0004429)
No. of Clusters (Meetings)	2812	2812
No. of Obs.	19635	19635
R^2	0.2736	0.4894

Coefficient estimates when the standard deviation of implied win probability within the race (our inverse measure of how even the race was) was regressed on an indicator variable equalling 1 if the race was a handicap race, and 0 otherwise. Control variables were added in Regression 2. (Races of class 1 or 2 are designated as top class). Heteroskedasticity-consistent standard errors (clustered at the meeting level) are in parentheses and ***, **,*, and . indicates significance at the 0.1%, 1%, 5%, and 10% level respectively.

Table 4. Sabotage		
Dependent Variable: Saboteur	All	All
Intercept	-5.380001***	-5.653535***
	(.0584403)	(.2031232)
Handicap Race	0.4022071***	0.4535086***
	(.068924)	(.0761776)
Jump Race		-0.9991198***
		(.1480697)
Top Class Race		0.3106882**
		(.105057)
No. of Runners		0.0114555
		(.0086976)
Win Prize Money (000s of GBP)		0.000268
		(.0008139)
Distance (000s of yards)		-0.1257629**
		(.045342)
Age		0.0839837
		(.0754047)
Age^2		-0.0067511
		(.0068603)
Implied Win Probability		2.628831***
		(.1965811)
No. of Clusters (Races)	19635	19635
No. of Obs. where Dep. Var.=1	1099	1099
No. of Obs.	183046	183046
Pseudo R^2	0.0028	0.031

Coefficient estimates when an indicator variable equalling 1 if the jockey was guilty of sabotage, and 0 otherwise, was regressed on an indicator variable equalling 1 if the horse was racing in a handicap race, and 0 otherwise. A logit specification was used and control variables were added in regression 2. (Races of class 1 or 2 are designated as top class). Heteroskedasticity-consistent standard errors (clustered at the race level) are in parentheses and ***, **,*, and . indicates significance at the 0.1%, 1%, 5%, and 10% level respectively.

Table 5. Sabotage: Further Analysis			
Dependent Variable: Saboteur	All	Handicap	Non-Handicap
Intercept	-5.193308***	-5.35927***	-4.113867***
	(.2511909)	(.334129)	(.3911165)
Std. Dev. of IWP in Race	-2.845232**	-2.931033*	-3.767819**
	(.9779897)	(1.491033)	(1.342089)
Handicap Race	0.3299036***		
	(.086028)		
Jump Race	-0.9911507***	-1.457102***	-0.2327904
	(.1491286)	(.1947396)	(.2467841)
Top Class Race	0.2878707**	0.2819007*	0.2649508
	(.1048194)	(.1368545)	(.169955)
No. of Runners	-0.0026094	0.0187636	-0.0472296*
	(.0096455)	(.0125658)	(.01982)
Win Prize Money (000s of GBP)	0.0003986	-0.0012708	0.0008536
	(.0008189)	(.0020322)	(.0008858)
Distance (000s of yards)	-0.1208595**	-0.0212889	-0.2905264**
	(.0452715)	(.053828)	(.0943828)
Age	0.0831949	0.1023864	-0.0417721
	(.0753054)	(.0996865)	(.1191283)
Age^2	-0.0067912	-0.0096903	0.0104456
	(.0068645)	(.0090205)	(.0104209)
Implied Win Probability	2.911083***	3.639366***	2.282971***
	(.240468)	(.3656254)	(.3212462)
No. of Clusters (Races)	19635	11766	7869
No. of Obs. where Dep. Var.=1	1099	787	312
No. of Obs.	183046	115023	68023
Pseudo R^2	0.0317	0.0338	0.0277

Coefficient estimates when an indicator variable equalling 1 if the jockey was guilty of sabotage, and 0 otherwise, was regressed on the standard deviation of implied win probability within the race and the control variables from Table 4. In the second and third regressions we break the sample down into handicap and non-handicap races respectively. A logit specification was used, heteroskedasticity-consistent standard errors (clustered at the race level) are in parentheses, and ***, **,*, and . indicates significance at the 0.1%, 1%, 5%, and 10% level respectively.

Table 6a: Effect of Sabotage (Wins)					
Dependent Variable: Winner	All	Hcap	Non Hcap	Jump	Flat
Intercept	-3.267838***	-3.291795***	-3.347433***	-3.256913***	-3.275038***
	(.0112462)	(.0155297)	(.0189034)	(.0196086)	(.0138467)
Saboteur	1.080884***	1.018631***	1.181665***	1.500179***	1.01618***
	(.0777645)	(.0931589)	(.145942)	(.2016752)	(.084767)
Implied Win Probability	7.115493***	7.683576***	6.946608***	7.011645***	7.182434***
	(.0600003)	(.0929683)	(.0830522)	(.0974899)	(.076624)
No. of Clusters (Races)	19635	11766	7869	6631	13004
No. of Obs. where Dep. Var.=1	19635	11766	7869	6631	13004
No. of Obs.	183046	115023	68023	58417	124629
Pseudo R^2	0.1372	0.0955	0.2042	0.1527	0.1293
Table 6b: Effect of Sabotage (Relative Performance)					
Dependent Variable: Performance	All	Hcap	Non Hcap	Jump	Flat
Intercept	-0.2948265***	-0.328384***	-0.2375801***	-0.2654715***	-0.308028***
	(.0012287)	(.0015566)	(.0017762)	(.0020627)	(.0014818)
Saboteur	0.1534108***	0.1589217***	0.1394553***	0.1686466***	0.1627182***
	(.0068394)	(.0083038)	(.0115928)	(.0173041)	(.0073596)
Predicted Percentile	0.0056673***	0.0063143***	0.0045702***	0.0059393***	0.005596***
	(.0000222)	(.0000282)	(.0000317)	(.0000391)	(.0000268)
No. of Clusters (Races)	19635	11766	7869	6631	13004
No. of Obs.	171991	108045	63946	48054	123937
R^2	0.2954	0.3278	0.2403	0.3494	0.2826

Two sets of regressions to establish the benefits that accrue to the saboteur as a result of sabotage. The top panel displays coefficient estimates when an indicator variable equalling 1 if the jockey/horse won the race, and 0 otherwise, was regressed on an indicator variable equalling 1 if the jockey was guilty of sabotage during the race, and 0 otherwise, and the implied win probability (as inferred from the odds). The full sample is analysed in regression 1, with sub-samples relating to handicap, non-handicap, jump and flat races following. The bottom panel displays coefficient estimates when *Performance*, as defined in Equation (5), was regressed on an indicator variable equalling 1 if the jockey was guilty of sabotage during the race, and 0 otherwise, and the predicted percentile of the horse (as inferred from an ordering of betting odds within the race). Heteroskedasticity-consistent standard errors, clustered at the race level, are in parentheses, and ***, **,*, and . indicates significance at the 0.1%, 1%, 5%, and 10% level respectively.

Figures

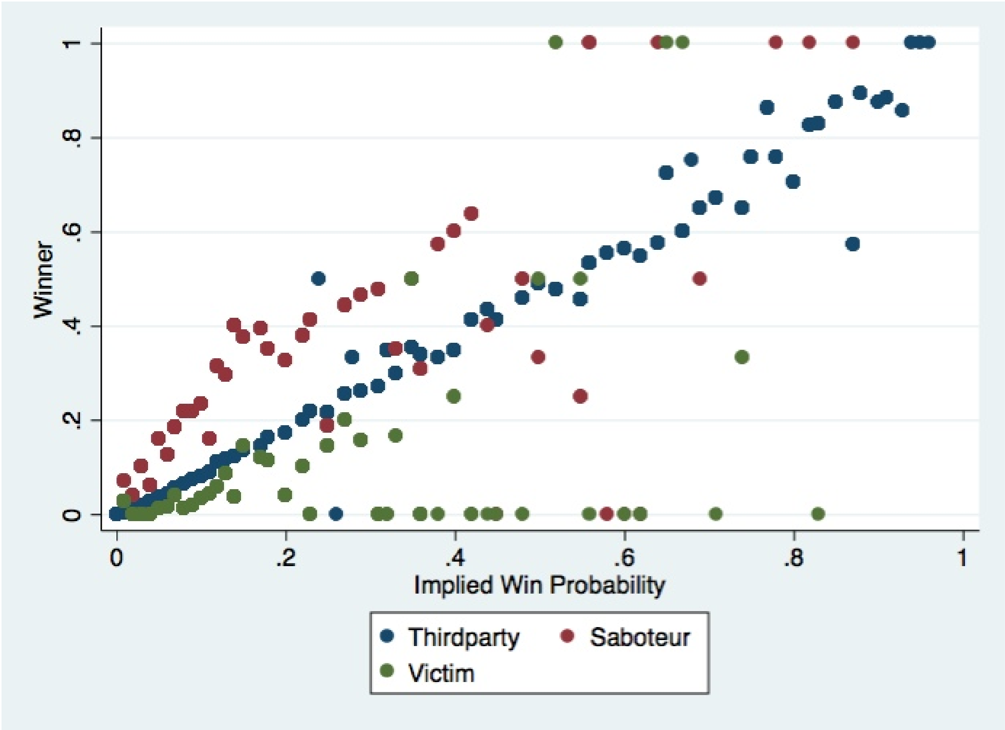

Figure 1: The average win indicator for saboteurs (red), victims of sabotage (green), and uninvolved third parties (blue). Averages are calculated for each subgroup, and for each implied win probability (inferred from the betting odds) rounded to the nearest 0.01.

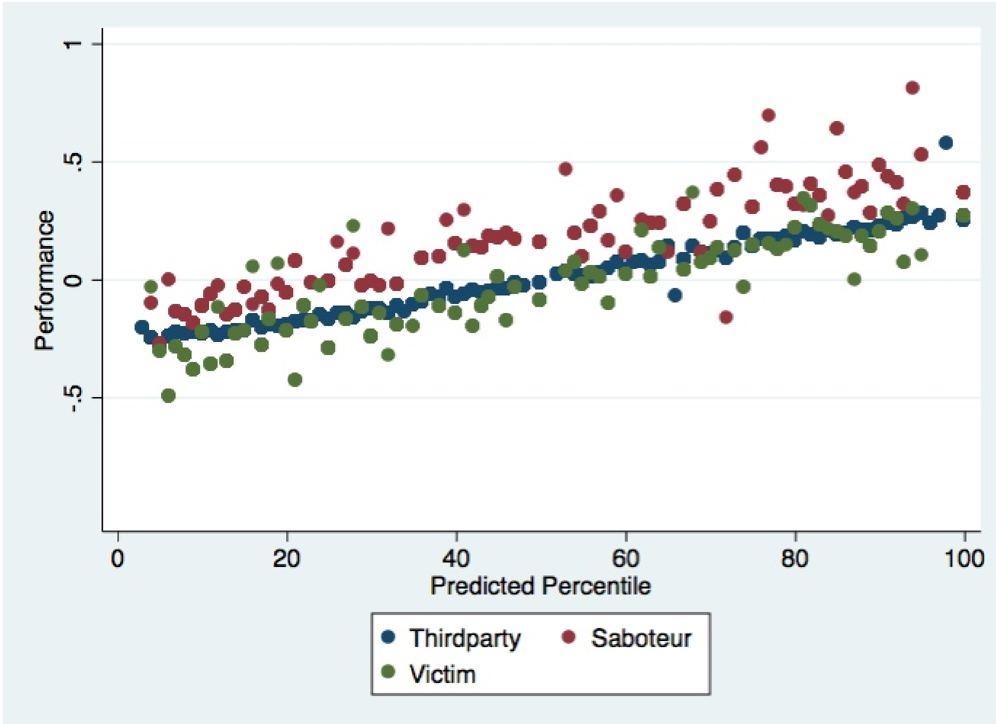

Figure 2: The average performance (as defined in Equation (5)) of saboteurs (red), victims of sabotage (green), and uninvolved third parties (blue). Average performance is calculated for each subgroup, and for each predicted percentile (as inferred from the betting odds) rounded to the nearest whole number.